EFFECTIVE AIR EXTRACTION SYSTEM AND SAFE PROTECTION FOR WELDING BAY IN INSTITUTION OF HIGHER LEARNING

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ABSTRACT

In this paper, the objective of the study is to determine the effective air extraction system and safe protection during welding process for welding bay in institution of higher learning. This thesis begin with a visitation at institution which have air extraction system to study more detail about this system. Some interview with the coordinator is needed to get their experience during handle their laboratory. The next step is design and fabricate the portable air extraction system for the analysis process. Its start with sketching, 3D drawing and fabrication. For the analysis, some distance and angles was taken to get the effective distance and angle of that system during welding process. The sample of the welding also was taken to determine the good distance of hood of the system before its disturbing the structure of the workpiece. So that the student will know the effective distance and angle and safe protection for the welding.

ABSTRAK

Objektif dalam thesis ini adalah untuk mengkaji keberkesanan sistem penyedut udara dan alat-alat keselamatan yang sesuai digunakan ketika proses pembelajaran khususnya untuk peringkat yang lebih tinggi. Thesis ini bermula dengan melawat beberapa tempat pengajian tinggi dalam bidang kimpalan untuk melihat dan mengenali dengan lebih dekat lagi sistem penyedut udara ini. Pengalaman daripada pakar-pakar dalam bidang ini amat diperlukan. Proses berikutnya adalah mencipta sendiri alat penyedut udara ini yang mudah alik untuk mengkaji kedukukan yang paling berkesan sistem ini ketika proses pengimpalan. Ianya bermula dengan proses lakaran, rekabentuk dalam 3 dimensi, dan seterusnya membuat sistem tersebut. Untuk proses analisis pula, beberapa jarak dan sudut diambil kira untuk mengkaji tahap paling berkesan ketika proses kimpalan. Sampel kimpalan juga dibuat untuk mendapatkan jarak yang selamat muncung penyedut udara itu agar tidak menggangu kelancaran dan struktur kimpalan. Dengan ini pengguna kimpalan dapat mengetahui jarak dan sudut yang paling berkesan serta kelengkapan yang selamat semasa proses kimpalan.

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LIST OF ABBREVIATIONS

AES	Air Extraction System
CAD	Computer-aided Design
CAE	Computer-aided Engineering
cm	Centimetre
TIG	Gas Tungsten Arc Welding
SMAW	Shield Metal Arc Welding

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Welding is a fabrication process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material (the weld puddle) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld.

Welding can classified many type. They are arc welding, brazing, oxyfuel gas welding, resistance welding, solid state welding, soldering and others. The popular one is arc welding. This is because this type is versatility; that mean it's readily applied to a variety of applications and a wide choice of electrodes. The most important is it has a low cost and easy to use. Welding also give many job and benefit to human.

Air extraction System must be working in a high efficiency to avoid the accident. This is because this system is function to extract the smoke during welding process especially for arc welding. The welder also needs a safety dress and protection such as glove, head cover, safety goggle, safety boot and etc. These gears will reduce the bad effect during welding process in the job site.

In a real world, welding is a popular step which means many people know how to do the welding process. Some people also make the welding for their minor money income and fully money income. This is because the salary for the welder is not so bad.

Unfortunately, welding also has an effect. Every year, thousands of welders suffer injuries as a result of accidents that occur because proper safety precautions are not followed at the job site. Accidents occur because of indifference to regulations, lack of information, or carelessness. Any injury can be painful and can incapacitate a person, or lead permanent disability or death.

The main effect of the welding is fumes or flux. Fumes are solid particles which originate from welding consumables, the base metal, and any coatings present on the base metal. Toxic gases may be used in, or generated by the process such as acetylene(C_2H_2), ozone (O_3), nitrogen oxides (NO), carbon monoxide (CO), generated when coatings on metal surfaces are heated such as epoxy resins, degreasing agents, paint and generated when the arc flash and some degreasing chemicals or paints react such as phosgene or phosphine. This gas is dangerous to the welder because its will effect the eyes and other body component. Fumes can cause symptoms such as nausea, headaches, dizziness, and metal fume fever. The possibility of more serious health effects exists when highly toxic materials are involved. For example, manganese overexposure can affect the central nervous system resulting in impaired speech and movement.

In addition to shielding gases that may be used, gases are produced during the welding process or may be produced by the effects of process radiation on the surrounding environment. Radiation is electromagnetic energy given off by the arc or flame that can injure eyes and burn skin. An operator sees visible light radiation. However, he does not see ultraviolet or infrared radiation. Radiation is often silent and undetected, yet injury occurs. Have all users learn about the effects of radiation. The effects of radiation depend on the wavelength, intensity, and length of time one is exposed to the radiant energy. Although a variety of effects is possible, the following two injuries are most common are skin burns and eyes damage.

Safety precautions are effective in reducing the occurrence of accidents at the job site. Safety means using common sense and avoiding serious accident. Established safety practices should be followed at all times. If good safety practices are consistently followed, an awareness of proper behavior is establish that usually prevents mistake.

1.2 PROBLEM STATEMENT

(i) The increasing level of accident and injuries among welding user at the job site. All of that effect can be painful and can incapacitate a person, or lead permanent disability or death.

(ii) Selection of the proper welding gear which following the specification of the welding safety.

1.3 OBJECTIVE OF THE PROJECT

(i) To design and fabricate the effectiveness of Air Extraction System.

(ii) To verify the effectiveness of Air Extraction System during welding process

(iii) To suggest;

- (i) Safety gear for welding bay.
- (ii) Safety gear from heat during welding process.

1.4 PROJECT SCOPE

This project is limited to the scope as follows;

(i) Research, Design and Fabricate the Air Extraction System.
(ii) Test-run and verify the Air Extraction System.
(iii) Research and suggest the safe protection during welding process.

1.5 REQUIREMENT

Hardware;

(i) Air Extraction System (for research),
(ii) Arc welding and complete welding apparatus including safe protection,
(iii) Computer and Computer Aided Design software.

Skill;

(i) Arc welding skill.
(ii) CAD skill (SolidWorks).
(iii) Fabrication skill.
(iv) Basic electrical knowledge.

CHAPTER 2

LITERATURE REVIEW

2.1 DEFINITION OF WELDING

Welding in its broadest sense can be defined as the process by which materials can be joined through the action of interatomic or intermolecular forces. Thus, welding, brazing, soldering and adhesive bonding can be considered welding processes. Soldering is a joining method that usees lead or tin based filler with a melting temperature not exceeding 450°C, and bonding is achieved by wetting of the base materials by the filler (solder). Brazing refer to joining using filler metals that have a melting point above 450°C, but well below the melting temperature of either base material joint.

A welded joint is produced (a) in the solid state by intimate direct contact under heat and/or pressure between the two materials being jointed, or (b) by melting and fusion of either side of the joint with or without a filler metal of melting point close to that of the base materials.

The earliest know welding process is probably the hammer or forge welding process. Over the years, several now ways of joining materials have evolved necessitated primarily by the stringent demands put on materials and their joints. Table 1 presents a complete list of various welding processes available today.

Table 2.1 Classification of Welding Processes

Group	Welding Process	
Arc Welding	Carbon arc	Electrogas
	Flux-cored arc	Gas metal arc
	Gas tungsten arc	Plasma arc
	Shielded metal arc	Stud arc
	Submerged arc	
Solid-state Welding	Cold welding	Diffusion welding
	Explosion welding	Forge welding
	Friction welding	Hot pressure welding
	Roll welding	Ultrasonic welding
Oxyfuel Gas Welding	Oxyacetylene welding	Oxyhydrogen welding
	Air acetylene welding	Pressure gas welding
Resistance Welding	Flash welding	Projection welding
	Resistance seam welding	Upset welding
	Resistance spot welding	
Other Welding Process	Electron beam	Electrolag
	Flow	Induction
	Laser beam	Percussion
	Thermit	

Focus to the learning institution of welding, they learn and practice the welding in a welding bay. Welding bay is design for a personal practice of welding especially at the institution which has welding learning and practice.

The overall size of the welding bay is 7feet to 10 feet wide and 5feet to 8feet long. This bay usually will have a welding apparatus for each bay. They also will have an Air Extraction System to extract the fumes which created during welding processes. This bay is exactly the best place to learn and practice welding process because that bay is a save and comfortable place to learn the welding process.

Figure 2.1: Sample of Welding Bay

2.2 FUMES AND GASES

Some of the welding, cutting, and allied processes produce fumes and gases, which may be harmful to your health. Fumes are solid particles which originate from welding consumables, the base metal, and any coatings present on the base metal.

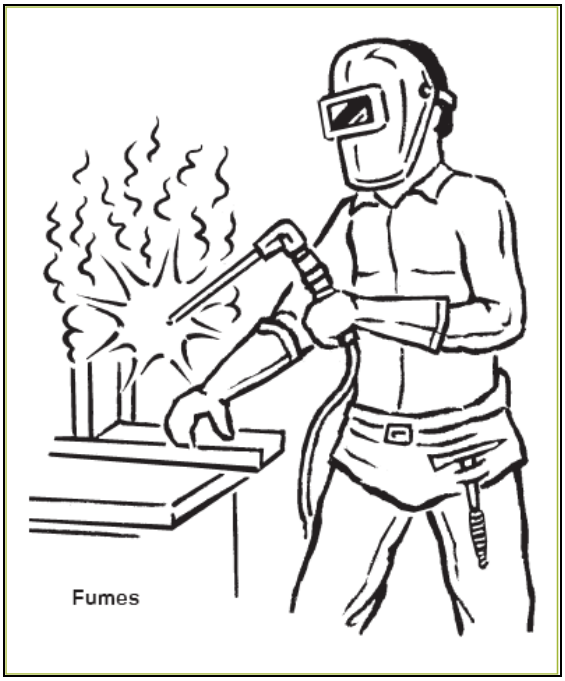

Figure 2.2: Fumes Shown during Welding Process

The welding exposure is unique. There is no material from any other source directly comparable to the composition and structure of welding fumes. However, the particulates and gases generated during welding are considered to be the most harmful exposure in comparison with the other byproducts of welding.

In addition to shielding gases that may be used, gases are produced during the welding process or may be produced by the effects of process radiation on the surrounding environment. Acquaint yourself with the effects of these fumes and gases by reading the Material Safety Data Sheets (MSDSs) for all materials used (consumables, base metals, coatings, and cleaners).

Table 2 Hazardous Byproduct of Welding

Fume	**Gases**	**Radiant Energy**	**Other Hazards**
Aluminum	Carbon Dioxide	Ultraviolet	Heat
Cadmium	Carbon	Visible	Noise
Chromium	Monoxide	Infrared	Vibration
Copper	Nitrogen Oxide		
Fluorides	Nitrogen Dioxide		
Iron	Ozone		
Lead			
Manganese			
Magnesium			
Molybdenum			
Nickel			
Silica			
Titanium			
Zinc			

The amount and composition of these fumes and gases depend upon the composition of the filler metal and base material, welding process, current level, arc length, and other factors.

Many possible effects of over exposure will be shown. Depending on material involved ranges from irritation of eyes, skin, and respiratory system to more severe complications. Effects may occur immediately or at some later time. Fumes can cause symptoms such as nausea, headaches, dizziness, and metal fume fever. The possibility of more serious health effects exists when highly toxic materials are involved. For example, manganese overexposure can affect the central nervous system resulting in impaired speech and movement. In confined spaces the gases might displace breathing air and cause asphyxiation.

Overexposure must be ovoid to get the higher safety. First of all, keep your head out of the fumes and do not breathe the fumes. Use enough ventilation or exhaust at the arc, or both, to keep fumes and gases from your breathing zone and general area. In some cases, natural air movement provides enough ventilation and fresh air. Where ventilation is questionable, use air sampling to determine the need for corrective measures.

Use mechanical ventilation to improve air quality. If engineering controls are not feasible, use an approved respirator. Work in a confined space only if it is well ventilated, or while wearing an air supplied respirator. Fumes from Welding or cutting and oxygen depletion can alter air quality causing injury or death. Be sure the breathing air is safe. Follow OSHA guidelines for permissible exposure limits (PELs) for various fumes.

2.3 AIR EXTRACTION SYSTEM

Fume extraction system also call Air Extraction System is a system which to sniff up the fume and smoke during the welding. This is very important system in welding process because this system will sniff up the smoke which shown when welding process because of the carbon at the electrode. All of that is a toxin. Examples of toxins are ozone, carbon monoxide, nitrogen oxides and fumes from highly toxic metals including cadmium, zinc, beryllium, lead, chromium, nickel, manganese and copper.

Fumes from some of these metals can cause cancer. Inert shielding gases may pose risks of oxygen depletion and therefore suffocation, especially in confined spaces. Some welding gases present risks of fire and explosion. The Air Extraction System is a solution from this entire toxin because it sniffs up all of that around its area cover and take it at the safe condition.

Figure 2.3: Sample of Air Extraction System

Air extraction System has two types, fixed and portable Air Extraction System. Fixed air extraction is use in a welding room (bay) and the portable Air extraction System is use at the other welding process place because it can move to every place which wants to make a welding process.

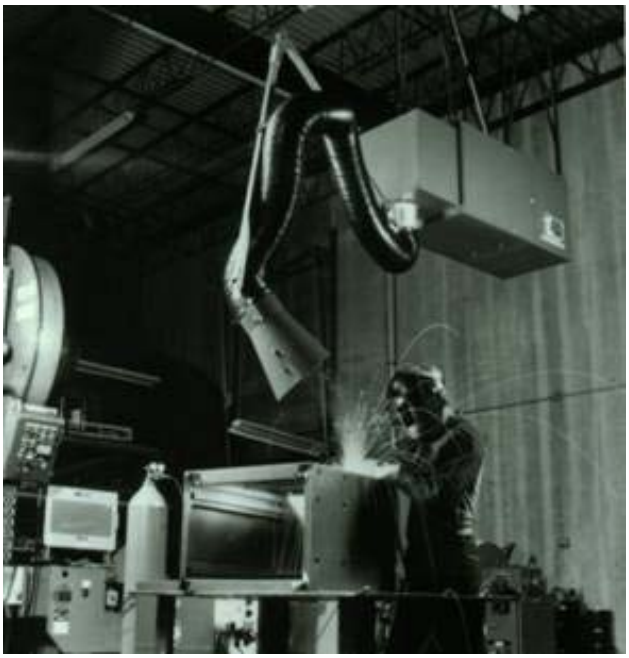

Figure 2.4: Fix Air Extraction System

Figure 2.5: Portable Air Extraction System